NSCA 2016 TACTICAL STRENGTH AND CONDITIONING ANNUAL TRAINING

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NSCA NATIONAL STRENGTH AND CONDITIONING ASSOCIATION
Rehabilitation and Reconditioning: It’s more than just traditional conditioning

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There is a need to understand how the integrated systems of the body are impacted on by injury...

... and how the systems must be considered in developing reconditioning / rehabilitation programs
Outcomes

• Explain the three components that provide stability and protection of the body during movement – The integrated system

• Describe how the Neuromusculo-skeletal systems interact during movement

• Identify which of the Neuromusculo-skeletal systems require rehabilitation and reconditioning for optimal performance.
Scenario

• Police officer complains of back pain.
  – What exercises do you prescribe?
Scenario

• Train the core?
  – Research suggests that the problem is not one of strength or endurance but of motor control (Jull, et al., 1999)
  – TrA thickness does not change above 20-30% MVC (Himes et al., 2012)

Scenario

• What if it was a ZAP Joint dysfunction?
  – Joint trauma
  – → muscle spasm
  – → inhibition? of deep muscles?
The Integrated System

The Integrated System

- Active system
- Passive system
- Neural System
- Neutral Zone
The Integrated System

The impact of injury
The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

Control System

Passive System

Active System
The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

– Joint does not move properly
  • Acute cause
    – e.g. ACL tear
  • Altered mechanics of movement
    – e.g. Increased laxity of the joint (Brukner & Khan, 2012)

The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

– Joint does not move properly
  • Chronic cause
    – e.g. Ankle DF ROM following an ankle sprain (Pope, et al., 1998)
  • Altered mechanics of movement
    – e.g. Stepping down, squatting
The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

– Pain

• Acute cause
  – e.g. ZAP joint injury
• Altered mechanics of movement
  – e.g. Change in movement patterns and inhibition (Brugger, 1984; Ebenbichler, et al., 2001)

http://i.dailymail.co.uk/i/pix/2009/09/19/article-1214722-068111DE000005DC-304_468x286.jpg
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Scenario 1: Passive System Dysfunction

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

- Control System Dysfunctions
  - Decreased / delayed muscle activation

- Inhibition

- Active System
  - Excessive Load
  - Muscle damage
  - Tendon damage

- Passive System

- Dysfunctional movement
- Pain
Scenario 2: Control System Dysfunction
Scenario 2: Control System Dysfunction

– Faulty Joint Position Sense

• Chronic cause
  – e.g. Recurrent ankle sprains (Hartsel, 2000)/ whiplash (Oddsdottir, & Kristjansson, 2012)

• Altered accuracy of movement
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Scenario 2: Control System Dysfunction

- Fatigue
  - Overload to the system / poor recovery
  - Neural input arrives too late
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Scenario 2: Control System Dysfunction
– Faulty motor control
  • Incorrect movement pattern
  • Incorrect muscle activation
    – E.g. Glutes vs hamstrings / TFL vs HF
    – Global vs local
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Scenario 2: Control System Dysfunction
  – Neurological injury / Neuropathy
    • Brachial plexus palsy
      – e.g. load carriage (Orr et al., 2013)
    • Weakness / Altered function
      – Scapula dysfunction
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Scenario 2: Control System Dysfunction

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

- Delayed / Slow Commands
  - Faulty Joint Position Sense
  - Fatigue
  - Faulty Motor Control
  - Neurological injury

- Excessive Load
  - Muscle damage
  - Tendon damage

Reinforce faulty motor patterns & poor JPS
The Integrated System & Dysfunction

Scenario 3: Active System Dysfunction
The Integrated System & Dysfunction

Scenario 3: Active System Dysfunction

– Muscle weakness
  • Absolute weakness
    – Weaker than external requirements
  • Typically load is too much
    – E.g. load carriage

https://s-media-cache-ak0.pinimg.com/236x/a4/57/57/a4575728022ee5423631e4617e9b0627.jpg
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Scenario 3: Active System Dysfunction

– Muscle weakness

  • Relative weakness
    – E.g. Weaker than opposing muscles
  • Upper/Lower Cross Syndromes
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Scenario 3: Active System Dysfunction

– Muscle weakness
  • Previous injury
    – E.g. Incomplete recovery
  • Re-injure weakened structure
    – E.g. Load carriage (Orr, et al., 2016)

Orr, R. M., Coyle, J., Johnston, V., & Pope, R. (2016). Self-reported load carriage injuries of military soldiers. *International journal of injury control and safety promotion*, Fig 1, pg 4
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Scenario 3: Active System Dysfunction
   – Muscle weakness
     • Fatigue
       – E.g. Excessive work/insufficient rest
     • Overload once capable structure
       – E.g. Jump landing (Orr, 2007)
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Scenario 3: Active System Dysfunction

Excessive Load
- Ligamentous damage
- Skeletal damage

Inhibition
- Decreased / delayed muscle activation
Faulty motor patterns

Excessive Load
- Muscle damage
- Tendon damage

Muscles too weak to overcome force
- Weakness – Absolute or Relative
- Previous injury
- Fatigue
The Integrated System & Dysfunction

So what?
So What?

• Member comes in post back pain
  – You give them core strengthening...but what if....
    • Poor motor timing (abdominals firing late)
    • Poor motor pattern (caused by poor technique)
    • Poor muscle activation (Gluteals not firing)
    • Faulty JPS (think they are in the right position)
    • Joint dysfunction (loss of joint ROM)

• ...means that you can't just give an exercise (e.g. core for lower back) and hope for the best...
The Integrated System & Performance

Considering this Integrated system and how it relates to performance
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The Length-Tension Curve

- A muscle fibres will develop most tension at between 90-110* of resting length.
- Joint position will influence which muscle takes up the most tension and receives the most stimulus.

http://4.bp.blogspot.com/-FhLuv77OsnI/U6XBzYO2i/IAAAAAAA9o/PqlCW1uO1HA/s1600/Force-Length-Graph-2.bmp
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The Length-Tension Curve

- It effects optimal loading for a muscle.
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The Length-Tension Curve

- It effects optimal position for muscle stretching.

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The Length-Tension Curve

- It can be used to compensate for weaker muscles
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Muscle activation and compensations

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OCK v CKC

- Both OCK and CKC are important
- The question is when to use them as part of reconditioning

http://i.telegraph.co.uk/multimedia/archive/03138/sydney-police-run_3138160c.jpg
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Complex Synergies – Shifts

- In a *countercurrent* movement, the biarticular muscle is an agonist at both joints simultaneously.
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Complex Synergies – Shifts

- In a concurrent movement, the biarticular muscle is an agonist at one joint and an antagonist at another simultaneously.

.Concurrent Movement
Segmental Summation of Velocity

- Optimal coordinated sequence of movement that allows for optimal velocity development
- Each segment begins to move the instant the previous segment begins to slow down

Elliott, B.C. Biomechanics in Sport in eds. Pyke, FS. Better Coaching, Australian Sports Commision, Figure 7-13, p.107

http://www.netfit.co.uk/public/images/assets/160.jpg
Segmental Summation of Velocity

Monfort-Panego, et al., 2009

- When Sitting Up
  - Initial phase of the exercise during dorsolumbar spine flexion the RA is activated then decreases when Lx is around 30*-45* HF activation increases

http://www.netfit.co.uk/public/images/assets/160.jpg
Considerations for Programming

• Is the Passive System Involved?
  – Mechanism of injury
  – Measure Joint Range (Goniometry) / Muscle stretch and retest (TDT)
    • Also applies with technique
  – Neuromuscular system treatments not having an effect.
Considerations for Programming

• Considerations for the Active System?
  – Check / Train strength / endurance
    • Through the required range and movement pattern
  – Check opposing movement strength / endurance
  – Watch loading
    • Too soon / long
  – Focus on full recovery (foundation then performance)
Considerations for Programming

• Considerations for the Control System?
  – Integrate the movement
  – Train the muscle to fire at the correct speed
  – Ensure correct muscles are active (no compensations)
    • Where do you feel it?
  – Check for faulty JPS (or refer) / Retrain
  – Check technique with required load/speed
Rehabilitation and Reconditioning

• The integrated systems need to be considered in terms of...
  – Downstream effects
  – Reconditioning / rehabilitation exercise and training dose selection

• Reconditioning / rehabilitation programs need to be well informed and well considered – it is more than just giving a known exercise

• One size fits no-one
References

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